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THE PRESENT SITUATION OF THE LASER INDUSTRY IN CHINA AND ITS DEVELOPMENT

by

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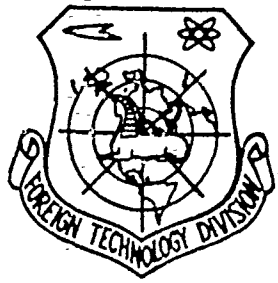

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TITLE: THE PRESENT SITUATION OF THE LASER INDUSTRY IN CHINA AND ITS DEVELOPMENT

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The development of laser technology has already become one of the important symbols of the development of science and technology in the 20th century. In conjunction with this, it will become one of the main pillars of the development of modern information technology. The laser industry has already received a high degree of attention from various advanced nations.

Our country's laser technology began to develop in the early 1960s and has developed rapidly for the last thirty years. At the present time, the whole country is engaged in the business of research on lasers and their applications. There are over 300 development units and production plants. Worker personnel engaged with lasers exceed ten thousand. Among these, experts and science and technology personnel make up 1/3. They have already set up a contingent in the laser industry which is of a considerable scale. In the areas of laser development and research, they have achieved nearly one thousand successful outcomes or products. Among these, length standards or criteria, laser fusion, satellite range finding, and other similar items have already entered into the ranks of the world's advanced nations. A number of laser materials, such as polarized boric acid barium crystals, are in a preeminent position internationally. Just as scholars outside China have said, "Speaking, then, in terms of the whole field of lasers, from basic research to the development of high power laser devices, and the applications of lasers, the power of China is quite great."

Our country's laser industry, on the basis of incomplete statistics, from 1981 to 1985, produced laser products worth a value of 230 million yuan. This is an increase in 5 year average value of 13%. The first four years of the "75" plan, all of China produced laser products worth a value of 400 million yuan. However, on the basis of incomplete statistics, in the "65" period, our country imported various types of laser device component parts and complete devices with a total value of over 150 million U.S. dollars. This

fact clearly demonstrates that, in spite of the fact that our country's laser science research level is fairly high, and its beginnings were relatively early, it is, however, true that laser products are unquestionablly still unable to satisfy domestic requirements in quality, quantity, or specifications. Because this is the case, speaking overall, the scale of our country's move toward the industrial production of lasers is still relatively small and remains in the formative and developmental stage.

Below, we make an analysis of the situation in the domestic laser industry. On the basis of statistical data supplied by over 100 of the key laser production units, from 1980-1989, the laser products produced in the whole country had the values shown in the table below.

① 年 份	②产值(万元)	③增长率(%)
1980	3184	
1981	2747	-13.7
1982	4386	59.7
1983	5299	20.6
1984	4466	-15.6
1985	5985	34.0
1986	7324	22.4
1987	8922	21.8
1988	11228	25.8
1989	13963	24.4

Statistics for the Value of Laser Products Produced Domestically in the Years 1980-1989 (1) Year (2) Production Value (10,000 U.S. Dollars) (3) Rate of Growth (%)

It can be seen that, in the period 1985-1989, the speed of the growth in the value of the laser products produced in our country, as compared to the speed of growth in the value of products produced by our country's industry during the same period, was much greater. In recent years, the situation for the value of classifications of the laser products of our country and their growth are as shown in the table below.

From the table it is possible to see that the total value of laser products for military uses and parts for devices possesses a relatively great weight. However, laser processing systems whose technology is relatively familiar and have relatively broad applications still occupy a relatively small relative weight (5% or less). Looking at the speeds of growth, in the last several years, laser medical treatment devices have developed very fast. As far as foreign, high quality products which have had the fastest development, such as laser typewriters, CD sound players, and other similar information products are concerned, up to the present time, they are still absent. Looking on the basis of the situation of our country's laser development, the development of our country's laser industry has the special characteristics below.

98

1 分类	1985年 2		1986年 2			1987年 2		
	3 产值(万元)	4 占百分比	5 产值(万元)	6 占百分比	7 年增长率(%)	8 产值(万元)	9 占百分比	10 年增长率(%)
11 军用系统	2363	39.4	2387	32.6	1.0	3104	34.8	30.0
12 器件、元件、材料	2171	36.2	2336	31.9	7.7	2810	31.5	20.1
13 检测系统	703	11.7	788	10.8	12.1	963	10.8	22.2
14 医疗系统	545	9.1	952	13.0	74.7	1301	14.6	36.7
15 加工系统	157	2.6	369	5.0	13.5	234	2.6	-36.6
16 其他	60	1.0	489	6.7	71.5	510	5.7	4.3
17 总计	5999	100	7324	100	22.1	8922	100	21.8

(1) Classification (2) Year (3) Production Value (10,000 U.S. Dollars) (4) Percentage Constituted (5) Production Value (10,000 U.S. Dollars) (6) Percentage Constituted (7) Annual Rate of Growth (%) (8) Production Value (10,000 U.S. Dollars) (9) Percentage Constituted (10) Annual Rate of Growth (%) (11) Military Use Systems (12) Devices, Parts, and Materials (13) Testing and Measurement Systems (14) Medical Treatment Systems (15) Processing Systems (16) Other (17) Total

1. The laser industry is a leading form of scientific and technological industry. Relatively high level or good quality laser parts and applications of whole systems all have developmental research institutes, universities, or powerful and influential large

plants supplying the production. These units have tremendous power. Their engineering technology personnel are good. Their proportion is high. Their accomplishments in application have been relatively numerous. They always organize their own small scale production or cooperatively manage production with a closely specialized enterprise. The turnover into accomplishments in scientific research has been relatively fast. Looking from the point of view of the present laser industry structure, domestic laser products are primarily coming from this type of unit. It is the main body of our country's laser production industry. This is completely determined by the special point of laser products having a form which brings knowledge and technology closely together. This is similar to the early periods in the formation of the industries of advanced countries.

Due to the fact that the situations above are bound to form, despite the fact that the scientific and technical level of our country is relatively high, it is true, however, that products are still in a state of being produced by hand in a laboratory. The industrial arts of production are relatively backward. It goes without saying that quality and quantity are both difficult to satisfy in terms of actual requirements. It follows from this that making our country into a producer of lasers is very different from advanced countries overseas. Looking at it in terms of the current situation, the turning of our country's laser products into commercial products is still at a relatively low level. The yearly value of production only approaches 100,000 yuan.

2. In the laser industry, products for military use assume a relatively large importance. In recent years, their value has accounted for approximately 30-40%. In second place, the relatively larger value of production is accounted for by parts, which occupy approximately 30%. The value of products produced for military uses is greatly influenced by trends in units, equipment, and international affairs. The total value produced is clearly not stable. Besides this, parts have relatively great importance. This also reflects the fact that the development of applications and promotion or

popularization has not been adequate. This is particularly the case with laser thermal processing which has production or output values that are extremely low and which still awaits vigorous development and promotion as well as the transition to commercial products by its systems.

3. In the last few years, the development of the laser industry in our country has been relatively fast. This is particularly the case with the recent construction of international cooperative and technology introduction projects, for example, Shentan (illegible) has brought in laser video discs and CD audio player production lines. Beijing has introduced He-Ne production lines. Shanghai joint ventures produce Ar^+ laser devices, as well as being in the midst of commercial negotiations associated with laser processing, laser typewiters, and so on, and so on. It is anticipated that the value of laser output will greatly increase and that the level and scale of the transition to a laser industry in our country will also present a greatly changed appearance. Besides this, our nation, in addition to laser products for military uses, already exports small amounts of laser crystals, non-linear crystals, as well as gas lasers, and medical treatment laser machinery. This also creates excellent conditions for our country's lasers to break into the international marketplace.

At the present time, the key problems that exist in the fomation of the laser industry in our country are:

1. The nation, up to now, has not had a comprehensive industrial development plan. Due to the lack of macro guidance, the laser industry, in the process of its formation, has been made to be very greatly self-generating and blind. For example, there are a number of laser production lines the introduction of which, due to deficiencies in market research, does not fit the national situation. To this is also added a deficiency in specialized technical talent suited to the job. For these reasons, the creation and assembling of products comes under increasing pressure or production lines are delayed and it is not possible to go into production, bringing with it huge economic losses. Also, another example is, in laser medical treatment machinery, various places competing with each other in its production, low levels of duplication, crude product control and manufacture, the

creation of large amounts of waste, and, in conjunction with this, a direct influence on the reputation of new technologies.

2. Lasers are a high technology product. Most domestic production points still use hand-made production methods. Not only do they not have advanced production equipment, they also lack modernized production management. As a result, production has yet to be organized into an industry. Production is also not capable of increasing rapidly. Up to the present time, a certain number of laser devices, such as Ar^+ have lives and stabilities which have not yet been very well determined. Industrial techniques for the production of laser devices with large amounts and broad applications of semiconductors has lagged behind. Quality is still not up to par. This is a stiking example. 99

3. The strength of laser production investment is very low. Up to the present time, the nation, in the field of lasers, has had almost no production investment. In the area of product development, there has also been very little dedicated. As far as various different areas and various departments are concerned, in this area, investment has also been extremely low. This is one of the key reasons for falling behind in the creation of our country's laser production.

The basic line of thought for developing our country's laser production is: adequately dig out our country's currently existing latent power, introduce and absorb advanced foreign production technology, and aggressively open up foreign and domestic laser markets.

Aim at the international marketplace, participate in international competition, use exports to create credit in order to drive the formation of our country's laser industry. These are the key strategic thoughts for developing our country's laser industry. As far as our country's current economic development level and scope is concerned, the development of high technology industries without participating in international competition is an impossibility.

We must exert the number of technological strongpoints which our country currently possesses and concentrate and take a firm grasp on the military use lasers of strategic weapons, laser crystals, and gas

laser devices, as well as other similar devices to do some exporting of products. We must get involved in large numbers of laser products in wide-ranging areas, such as laser machinery for medical treatment, laser processing machinery, and so on, and organize its development and production. In conjunction with this, we must unceasingly raise quality and speed up the up-grading and generation replacement of products, expand the number of types of products and form production capability as fast as possible. We must strengthen international cooperation, aggressively introduce advanced technology , such as laser devices, laser information products and other similar production technologies. We must have a plan to set up a production foundation of scientific research which not only has modernized production capabilities but also has relatively solid real power. We must strive to raise the quality of the parts or elements of laser devices. This is particularly true of raising the quality of laser parts which are frequently used. At the same time that we must strongly expand the applications of laser technology, we must strengthen the development of new technologies and new applications, paying serious attention to basic research on laser technology.

The target for the development of our country's laser industry is to use 5-7 years time to construct a newly emerging laser industry which basically satisfies domestic needs, and, in conjunction with this, has a certain export scale and a certain capability for international competition. By the year 2000, the value of laser output will reach a level corresponding to the level of the U.S. in the late 1980s.

In the "85" period, our nation's laser technology will occupy a key area in China's economic construction, having great and striking applications like such fields as automobile production, machinery manufacture, electronics products, and other similar areas, and, in conjunction with this, will achieve striking economic benefits.

In the important researc' and cutting edge fields of laser technology, we continue to track an advanced international level. In conjunction with this, in certain important fields, we strive for br eakthroughs.

The important fields in the development of our country's laser industry are:

1. Laser Devices and Components: These include high power CO_2 lasers, Ar^+ lasers, YAG lasers, quasi-molecular lasers, as well as laser crystals, non-linear crystal materials, and so on, and so on.

2. Laser Processing: This includes high power CO_2 and YAG laser processing systems, quasi-molecular precision laser processing devices, and so on, and so on.

3. Laser Medical Treatment: Includes various types of laser medical treatment systems and laser pathology diagnostic instruments, as well as other similar systems.

4. Lasers for Military Use: This includes laser range finding, causing of blindness, guidance, as well as tactical simulation systems, and so on, and so on.

5. Laser Checks and Measurements: These include laser collimation, guidance, as well as on line checks and measurements, no damage test systems, and other similar systems.

6. Laser Information Products: This includes laser printing, typing, CD, LV, as well as document storage and filing systems, and other similar devices.

III.

In order to realize the establishment of the strategic targets of our country's laser industry, our nation must point leadership systems, political policy measures, as well as investment upward toward the selection of effective measures. We make the following recommendations.

1. Break through departmental and regional limitations and develop lateral integration. Take certain technologies or a certain type of laser product to be the dragon's head. Organize scientific research units and production units in integrated management and integrated development. Have basic areas in the development of laser industries, for example, Beijing-Tianjin, Shanghai-Ningbo, Xian, Chengdu-Chongqing, Wuhan, and other similar areas. Make adequate use of the basis we have now to set up groups of enterprises. Get familiar with one, and set up one. The groups would independently plan their own industrial development, setting up between them loose or close relationships. They would receive macro guidance from the nation above them.

The enterprise groups can take scientific research--industrial development--sales--service, and other similar links and meld them into a whole in order to do a good job of pioneering laser applications, expanding laser technology, and developing technical service work. The various groups are also capable of correspondingly setting up laser processing, testing and service centers, laser medical treatment centers, and laser product quality control centers, as well as other similar organizations.

In the enterprise groups, the core enterprises or production foundation can be organized according to the method below.

(1) Take technological development oriented research institutes as the foundation. Recieve participation from the factories. Gradually set up pioneering types of scientific and technological enterprises. Due to the fact that relatively high level laser products possess the special characteristics of batch production in small lots, numerous types of products, and high requirements, they are suited to taking research institutes as the foundation for organizing production. At the same time, they should be research institutes that possess a certain production capability to create conditions for setting up modernized means of production.

(2) With factories that have relatively strong powers of technological development as the center and integrated with research institutes, organizing scientific research-production integral wholes, it is also possible to take factories that have relatively closely related specializations and change them into laser product production bases. In the process of forming enterprise groups, one must adequately bring into play the research institutes which our country already has as well as the advantages of high schools in the area of scientific research on lasers, and the advantages of military product "military turned civilian" production units.

(3) Stimulate scientific research personnel in taking on high technology enterprises that make contributions or have specialized utility or are organized into various types of small scale forms having specialized features in order to develop and produce laser products and gradually expand them.

(4) Opt for the selection of international cooperation in various forms. Do everything possible to absorb foreign enterprises'

jointly managed high technology laser companies in order to make them become the backbone enterprises of our nation's laser industry or the base for exporting to create credit.

2. Stimulate exports. High technology products are highly profitable. They should be seriously looked at and encouraged as high technology exports. This is not only capable of creating credit for the nation. Moreover, it makes the quality of laser products come up to international standards, raising our country's technological development and production level. It is necessary to select products which have the special character of our country and are also suitable for export. We should select those which are excellent for the establishment of laser product export bases or enterprise groups with the power for export expansion, which are approved by the state, and, in conjunction with that, offer several types of favorable aspects.

3. The state should make a decisive move into laser technology, product development, and have an arrangement for all aspects of product production. The state should have specialized organizations to add to organizational coordination, opt for the selection of methods for the concentration of capital through multiple channels, small investment of our own funds, abundant output, side investment, side profit taking, using output to foster progress, and other similar principles. The main point is that it is possible, from localities, departments, production plants, and through various types of channels, to gather capital from many quarters, as well as nationally supplied loans and partially secured funds, in order to set up laser technology bases, opting for the use of roll over methods to make active use of limited funds.

The nation must pay serious attention to the production technology of laser products and research on industrial techniques. It must appropriately increase the strength of investment in the area of product technology construction. In conjunction with this, it must introduce the advanced foreign production technology and equipment for a number of important products, increasing the actual productive power of our nation's laser industry. At the same time, we must organize scientific and technological power to digest, absorb, and gradually convert this to domestic manufacture.

4. Fiscal administration and revenues provide economically favorable aspects. As far as lasers and this type of new industry, in which intellectual power and technology are closely concentrated, are concerned, one should opt for the use of economically favorable policies similar to those in the microelectronics industry. Enterprises engaged in laser product production and development are capable of reducing and avoiding taxes which are levied and collected, avoiding and adjusting taxes. 10% of sales quotas are capable of being used for the development of new products and being figured into the production costs.

In the case of all new products in the country or perhaps on a market by market or item by item basis, for three years, they would be exempt from income tax and regulatory taxes. 50% of the profits could be used for the development of new products and equipment renovation.

Various areas and departments should take laser industry development projects and enter them into national torch plans or the torch plans for the areas or departments in question in order to facilitate doing everything possible to win the enjoyment of the various types of relevent economic advantages.

5. Serious attention should be paid to the work of standards and measurements or estimates, as well as to taking a firm grasp on product quality. This is particularly important in the phase of industrial formation. In accordance with the principle of "moving toward a close adherence to international standards", we must exert every effort to opting for the use of advanced international standards. As far as laser products, which still do not have international standards, are concerned, we should join together with the national standards department and the relevent research and production units to set out unified national standards to guarantee the serialization and standardization of laser products in order to make laser products of the same type interchangeable. Important laser products or those which are produced in relatively large lots must develop their work in quality assurance. On a national scale, there must be periodic comparisons and appraisals as well as activities to evaluate quality in order to promote the various types of laser products' fostering the good, discarding the bad, and continuously improving.